



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,666	10/29/2003	Takatoshi Deguchi	032071	4071
38834	7590	04/27/2005	EXAMINER	
WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP 1250 CONNECTICUT AVENUE, NW SUITE 700 WASHINGTON, DC 20036			BEREZNY, NEMA O	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 04/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

SM

Office Action Summary	Application No.		Applicant(s)	
	10/695,666		DEGUCHI, TAKATOSHI	
	Examiner		Art Unit	
	Nema O. Berezny		2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12, 13 and 15-18 is/are rejected.
- 7) ☒ Claim(s) 11 and 14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>03092005</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to Applicant's Amendment filed 2-17-05, which has been entered and considered. Claims 1-18 are currently pending.

Specification

The objection to specification, made in prior Office Action is hereby withdrawn, subsequent to corrections made by Applicant in Amendment filed 2-17-05.

Claim Objections

The objection to claim 2, made in prior Office Action is hereby withdrawn, subsequent to corrections made by Applicant in Amendment filed 2-17-05.

Claim Rejections - 35 USC § 112

The rejection of claims 3, 8, 11, and 14 under 35 USC 112, second paragraph made in prior Office Action is hereby withdrawn, subsequent to corrections made by Applicant in Amendment filed 2-17-05.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10, 12-13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dalton et al. (6,720,249) in view of Takase et al. (6,051,508). Dalton discloses a method for manufacturing a semiconductor device for forming a wiring by a dual damascene method, the method comprising the steps of: forming a mask (Figs. 1-10 el.40,50,60) for a wiring trench patterned to be a wiring trenches pattern (el.90) on an interlayer dielectric film (el.30); forming a mask (el.110) for a via hole patterned to be a via holes pattern (el.120) on the mask for the wiring trench (Fig.3); forming a hole shallower than a thickness of the interlayer dielectric film in the interlayer dielectric film by processing the interlayer dielectric film, using the mask for the via hole (Fig.4); forming a wiring trench in the interlayer dielectric film by processing the interlayer dielectric film, using the mask for the wiring trench (Fig.7), and simultaneously forming a via hole by passing the hole through a base layer (el.20); and embedding a wiring material (el.130) in the wiring trench and said via hole (Fig.9). However, Dalton does not disclose a multilayered resist. Dalton would look to one such as Takase for fabrication protection because Takase discloses using a multilayered resist (Fig.3D el.27,29,30). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the multilayered resist of Takase with the method of Dalton for protection from subsequent fabrication steps, such as an oxygen plasma treatment (col.5 lines 36-43) **[claim 1]**.

Dalton also discloses wherein said step of forming the mask for the wiring trench includes the steps of: forming a first (el.40), a second (el.50), and a third (el.60) hard mask in this order on the interlayer dielectric film (Fig.1); and processing the third

Art Unit: 2813

hard mask so as to be a plane shape to the wiring trench (Fig.2), and wherein the second hard mask is made from a different material from the first and the third hard mask (col.5 lines 10-15, 43-48) **[claim 2]**; wherein each of the first to the third hard mask are made from one kind of inorganic material selected from the group consisting of silicon nitride: silicon dioxide, silicon carbide, amorphous hydrogenated silicon carbide, silicon carbide nitride, organo-silicate glass, silicon rich oxide, tetraethylorthosilicate glass, phosphosilicate glass, organic siloxane polymer, carbon doped silicate glass, hydrogen doped silicate glass, silsesquioxane glass, spin-on glass, and fluorinated silicate glass (col.5 lines 10-15, 43-54) **[claim 3]**; wherein the first hard mask is between 30 nm and 100 nm thick (col.5 lines 8-9); the second hard mask is between 50 nm and 200 nm thick (col.5 lines 43-44); and the third hard mask is between 30 nm and 100 nm thick (col.5 lines 45-47) **[claim 4]**; and wherein the interlayer dielectric film is made from an organic material (col.4 lines 61-63) **[claim 5]**.

Based upon the rejection of claim 1 above, Dalton does not disclose a mask for the via hole comprising an organic film, an inorganic film, and a photoresist layer on the wiring trench mask. However, Dalton would look to one such as Takase for fabrication protection because Takase discloses wherein said step of forming the mask for the via hole includes a step of forming an organic film (Fig.3D el.27), an inorganic film or spin-on glass film (el.29), and a photoresist layer (30) in this order on the mask for the wiring trench (col.8 lines 4-16). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the layers of Takase with the method of

Dalton for protection from subsequent fabrication steps, such as an oxygen plasma treatment (col.5 lines 36-43) **[claims 6, 7]**.

Based upon the rejection of claim 6 above, Takase also discloses wherein a thickness of the inorganic film is thinner than a total film thickness from the first to the third hard mask (col.8 lines 4-10). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thickness of layers of Takase with the method of Dalton. Since the mask serves as a barrier, adequate thickness is necessary **[claim 8]**.

Based upon the rejection of claim 6 above, Takase also discloses wherein the organic film is between 100 nm and 400 nm thick (col.8 lines 4-5); the inorganic film is between 30 nm and 200 nm thick (col.8 lines 6-7); and the photoresist layer is between 100 nm and 300 nm thick, supposing the interlayer dielectric film is between 100 nm and 600 nm thick (col.7 lines 27-31). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thickness of layers of Takase with the method of Dalton. An interlayer dielectric film separates wiring layers and therefore needs to be a larger thickness to prevent interference **[claim 9]**.

Based upon the rejection of claim 6 above, Takase also discloses wherein said step of forming the mask for the via hole includes the steps of: processing the photoresist layer so as to be a plane shape to the via hole; processing the inorganic film so as to be a plane shape to the via hole by using the photoresist layer as a mask, and processing the organic film so as to be a plane shape to the via hole by using the inorganic film as a mask (Fig.3D); and simultaneously removing the photoresist layer

Art Unit: 2813

(Figs.3E-3F). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the processing steps of Takase with the method of Dalton. A second photoresist layer for a mask would not be necessary by using the inorganic layer as a mask **[claims 10, 13]**.

Based upon the rejection of claim 1 above, Takase also discloses wherein said step of forming the mask for the via hole includes a step of forming an organic film (el.27) and a photoresist layer (el.30) containing Si in this order on the mask for the wiring trench (col.8 line 4). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the films of Takase with the method of Dalton since organosiloxane and SOG don't need a separate planarization step (Takase – col.5 lines 8-12, 21-23) **[claim 12]**.

Based upon the rejection of claims 6 and 12 above, Takase also discloses wherein a thickness of the organic film is thinner than that of the interlayer dielectric film (col.7 lines 27-31; col.8 lines 4-5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thicknesses of Takase with the method of Dalton. An interlayer dielectric film separates wiring layers and therefore needs to be a larger thickness to prevent interference **[claims 15, 17]**.

Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dalton in view of Takase as applied to claims 1, 6, and 12 above, and further in view of Pan et al. (2004/0023497). Dalton in view Takase do not disclose a film exposed at a wavelength of 248, 193, or 157 nm. However, Dalton and Takase would

Art Unit: 2813

look to one such as Pan for small patterning dimensions because Pan discloses wherein a film exposed by light at a wavelength of 248 nm, 193 nm, or 157 nm is formed as the photoresist layer (p.1 para.5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the exposure wavelengths of Pan with the method of Dalton and Takase because smaller patterning dimensions can be achieved at these wavelengths (Pan – p.1 para.5).

Allowable Subject Matter

Claims 11 and 14 were previously allowed if rewritten in independent form, and are therefore still allowable for reasons of record.

Claims 11 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant's arguments with respect to claims 1-18 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

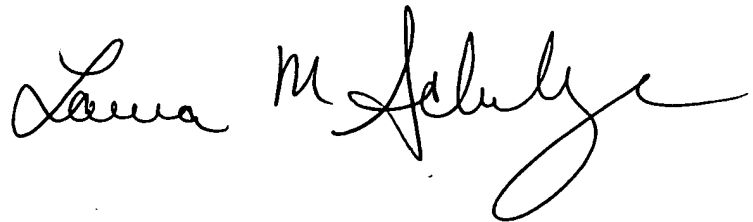
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O. Berezny whose telephone number is (571) 272-1686. The examiner can normally be reached on M-F 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2813

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB

A handwritten signature in black ink, appearing to read "Laura M. Schulze". The signature is fluid and cursive, with the first name "Laura" written in a larger, more prominent script than the middle initial "M" and the last name "Schulze".